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Abstract

Public housing projects are hotly debated, especially due to their impact on neighboring properties. This impact is theoretically ambiguous; public housing projects could enhance local amenities through agglomeration externalities or direct government provision, however, the concentration of low-income households could trigger negative spillovers. The expansion of the housing stock is also an important channel for large projects. While the impact of public housing projects is well-studied in developed countries, to the best of our knowledge, there is no rigorous empirical study on developing countries. In this paper, we study a large public housing project known as the *Mehr housing project* in Iran that facilitated the construction of two million affordable apartments, making it the largest public housing project in the world. We use the exact delivery date of Mehr units and their postal region to set up a difference-in-differences strategy. Using the universe of house transactions for 19 large cities in Iran between 2010 and mid-2019, we compare house price changes in Mehr postal regions to non-Mehr ones before and after Mehr units were delivered. Our results show that Mehr units lowered house prices in the same postal region by around 11 percent (significant at five percent). This effect is robust to controlling for city by time fixed effects, differential trends for suburbs, and regions with higher initial property values. We also provide suggestive evidence on the role of disamenity effects by looking at the heterogeneity of results across different house types and cities over time. Finally, we find a significant positive effect of available schools in the Mehr postal region that fits well with the amenity story.

Keywords: Externality, public housing, affordable housing, Iran, Mehr housing project.

JEL Classifications: H23, H43, R31, R38.

ملخص

تشهد مشروعات الإسكان العام نقاشاً ساخناً، وخصوصاً بسبب تأثيرها على المنشآت المجاورة. هذا التأثير غامض من الناحية النظرية، حيث يمكن لمشروعات الإسكان العام أن تعزز المرافق والخدمات المحلية من خلال تأثير هذه التجمعات السكنية على المناطق المحيطة أو توفير الحكومة لهذه المرافق والخدمات مباشرة للمناطق المحيطة، ومع ذلك، فإن تركيز الأسر ذات الدخل المنخفض يمكن أن يؤدي إلى تداعيات سلبية. ويعد التوسع في المخزون السكني أيضًا قناة مهمة للمشروعات الكبيرة. فعلى الرغم من أن تأثير مشروعات الإسكان العام مدروساً دراسة جيدة في البلدان المتقدمة، وهذا على حد علمنا، إلا أنه لا توجد دراسة فعلية شاملة عن البلدان النامية. وفي هذه الورقة، ندرس مشروع إسكان عام كبير يُعرف باسم مشروع مهر السكني في إيران والذي قام ببناء مليوني شقة بأسعار معقولة، مما يجعله أكبر مشروع إسكان عام في العالم. ونستخدم تاريخ التسليم الفعلي لوحدات مهر والمنطقة البريدية الخاصة بها لإعداد استراتيجية "الاختلاف في الاختلافات". وباستخدام بيانات بيع وشراء المنازل في 19 مدينة كبيرة في إيران بين 2010 ومنتصف 2019، نقارن تغيرات أسعار المنازل في المناطق البريدية في مهر بتلك التي لا تتبع مهر قبل وبعد تسليم وحدات مهر. تُظهر نتائجنا أن وحدات مهر أدت إلى تخفيض أسعار المساكن في نفس المنطقة البريدية بنحو 11 في المائة (الدلالة عند خمسة في المائة). ويعد هذا تأثير قوي لتحديد الآثار على المدن عند

وقت محدد ثابت، والاتجاهات التى تعتمد على الاختلافات بالنسبة للضواحي، والمناطق التى يوجد بها عقارات ذات أسعار أولية أعلى. ونقدم أيضًا أدلة موحية حول دور آثار عدم وجود مرافق وخدمات بالنظر إلى عدم تجانس النتائج عبر أنواع المساكن والمدن المختلفة بمرور الوقت. وأخيرًا، فقد وجدنا تأثيرًا إيجابيًا كبيرًا للمدارس المتاحة في منطقة مهر البريدية والذى يعكس بقوة تأثير توفير المرافق والخدمات.

1. Introduction

Housing costs make up a significant portion of the cost of living in various developed and developing countries. For example, roughly 12 million American households are paying more than half of their incomes on housing, and more than 25 percent of American renters are paying more than 30 percent of their incomes for rent (Charette et al., 2015). In Iran, about ten percent of households are paying more than half of their incomes on housing, and, on average, urban Iranian households spent about 36 percent of their expenditures on housing in 2019 (Statistical Center of Iran). With high housing costs, many families, especially poor ones, are finding it increasingly difficult to afford all their necessities such as housing, medical expenses, food, and transportation.

Governments use a variety of methods to intervene in the housing market, especially to provide housing for low-income households. Two prominent examples are the construction of subsidized units and the allocation of free land for housing construction. One of the main categories of government interventions for low-income housing is to build, either directly or indirectly, public, and affordable housing. Public housing intends to provide decent and safe housing for eligible low-income families.

While affordable housing construction benefits targeted groups, it might create significant spillovers on nearby properties. It is very important to take into account these externalities to evaluate such interventions. If public housing leads to the redevelopment of the neighborhood and the improvement of amenities, positive externalities follow (Baum-Snow & Marion, 2009; Schwartz et al., 2006). However, the concentration of low-income households, combined with poor construction quality, could trigger negative externalities (Diamond & McQuade, 2019; Tighe, 2010). Many studies evaluate the externality of affordable public housing on nearby property values in the United States (Baum-Snow & Marion, 2009; Diamond & McQuade, 2019; Ellen et al., 2007; Ihlanfeldt, 2019; Schwartz et al., 2006). There are also similar studies in other developed countries (Davison et al., 2017). Yet, to the best of our knowledge, there is no empirical study of such externalities in developing countries. The externality of public housing projects might be very different in developing countries like Iran due to poor government effectiveness and lack of trust from citizens. This study tries to fill this gap by providing estimates of the externality of a very large public housing project in Iran as a developing country.

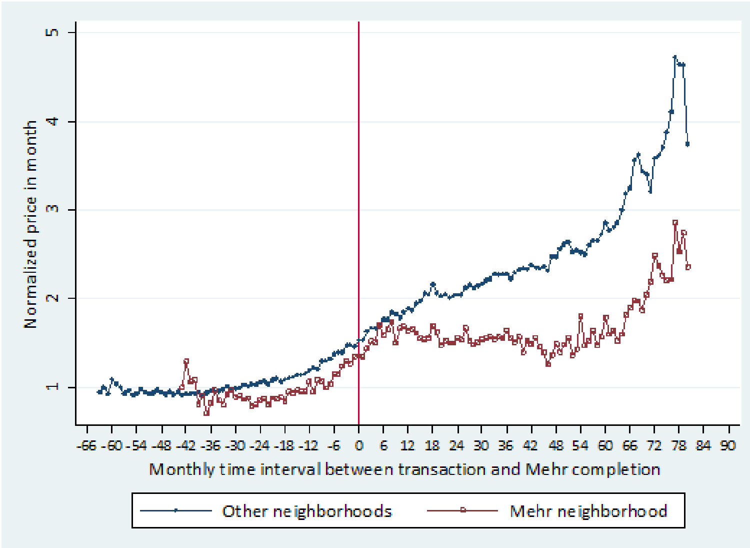
At the beginning of 2007, Iran's government announced a plan to subsidize the construction of around two million housing units to slow down the sharp rise in house prices. This plan, popularized as the *Mehr housing project*, targeted apartments suitable for low- and middle-income households. Most of these units were built as concentrated complexes in the suburbs of cities. It was estimated that this scheme cost about USD 150 billion (33 percent of GDP of Iran at that time) and it doubled the monetary base of the economy (Rahpoo Sakht corporate, 2012). Furthermore, it was planned to build houses in most of the cities all over the country (1,135 cities out of about 1,200 cities).

One of the distinguishing features of this public housing project was that it was planned to be implemented in most of the country's cities in a very short period. The speed of the Mehr projects varied across cities, which allows us to identify its impact on neighboring properties. Three potential mechanisms shape the overall effect of public housing on neighboring property values. The first mechanism that leads to an increase in the value of surrounding houses is the amenity effect, such as the removal of vacant lots and improvements in the community facilities. A counter-veiling mechanism is the disamenity effect. Lower construction quality, inconsistency with the architecture of the environment, concentration of low-income households, and greater congestion in the neighborhood are all potential disamenity effects which reduce the value of neighboring properties. The third mechanism is the supply effect, which might be particularly important for our study due to the large number of Mehr housing units delivered. This last channel reduces prices by shifting supply outward and is, in essence, what the government intended.

To find the effect of Mehr housing units on nearby property values, we merge house transactions data in 19 large Iranian cities between 2010 and 2019 with information on the completion of Mehr housing projects. The house transactions data are from the Tenement Management Information System (TMIS) maintained by the Ministry of Industry, Mine, and Trade, which provides detailed public records on all house transactions in Iran. Information about Mehr projects is acquired from the Ministry of Road and Urban Development. The two datasets are combined at monthly date and postal region levels.

Using a difference-in-differences (DID) strategy, we compare house prices in the postal region of the Mehr project in each city before and after its completion with other prices in other postal regions. We use the exact completion time of Mehr projects in each city for identification and argue that this timing is fairly exogenous. Figure 1 shows normalized house prices in Mehr postal regions and non-Mehr postal regions. On the horizontal axis, we show time relative to the time of Mehr project completion in each city. The trend of house prices in both regions is similar right until the delivery of the first Mehr unit. About a year after the first Mehr unit is delivered, we see a divergence between the two trends. This figure confirms the idea that our control and treatment groups are similar. It also provides visual evidence on the negative impact of Mehr housing projects on their neighboring properties.

Figure 1. Normalized price trends in the Mehr neighborhood with respect to other neighborhoods



Notes: Prices per square in each month of each city are averaged and divided by the average housing price of that city in 2010 and then the trends of the Mehr neighborhood and other neighborhoods are compared.

Our preferred DID specification includes postal region, time, and city by time fixed effects to control for postal region time invariant characteristics and city-specific flexible time trends. Our results show that property values in Mehr neighborhoods declined by about 11 percent after the first Mehr unit was delivered. This result is consistent with supply and disamenity effects. Mehr projects created a significant supply shift in the study cities and increased the stock of housing between 1.5 to 27.5 percent in these cities. Given the scale of the projects, we cannot rule out supply effects, but we provide four pieces of evidence that suggest some role for the disamenity effect.

First, the disamenity effect is expected to have a homogeneous effect on properties with different built-up areas, while the supply effect is thought to be stronger for close substitutes of Mehr units. However, we do not find a significant difference between the Mehr effect on housing units in a similar area band (75-110 square meters) compared to units in other area bands. This result is more consistent with the disamenity effect compared to the supply effect.

Second, if the supply effect fully explains the negative result, we would expect a larger Mehr impact in cities with larger Mehr projects. We estimate separate regressions for each city and plot the coefficients against the scale of Mehr projects. This, again, does not show a clear correlation between coefficients. Therefore, the Mehr impact seems to be similar across cities with varying Mehr scales.

Third, we look at the timing of the Mehr effect. We observe that the negative impact appears the second year after the delivery of the first Mehr unit. Specifically, we do not find a significant negative impact during the first two years after project completion. The timing of the effect is more consistent with an amenity impact that materializes after Mehr residents move in gradually. The supply effect is expected to reflect sooner, either before the units are completed or upon project completion.

Finally, anecdotal evidence shows that the local infrastructure did not develop at the same time as the completion of the Mehr projects. Many residents complained about the unavailability of basic utilities (electricity, water, gas) as the increased congestion created shortages. Schools, clinics, and other facilities of the neighborhood also did not expand proportionately. There were also reports of low-quality construction materials, which further exacerbated public opinion toward Mehr localities. We do not observe all available amenities and only have access to the number of schools in the Mehr postal regions. We find that the negative Mehr impact is smaller for postal regions that witnessed a proportionate increase in the number of schools. This final result confirms the importance of the disamenity effect in shaping the overall negative impact of Mehr projects.

The paper proceeds as follows. Section 2 reviews the literature. Section 3 discusses a simple model and conceptual framework. Section 4 provides institutional background on Mehr housing projects and describes our data sources, while section 5 discusses our empirical strategy. Section 6 presents our results and robustness checks and, finally, we conclude.

2. Literature review

Similarly to asylum seeker reception centers (Daams et al., 2019), homeless facilities (Gibson, 2005), high-density residential buildings (Ruming et al., 2012; Searle & Filion, 2011), power plants (Davis, 2011), metro stations (Diao et al., 2017), and community gardens (Voicu & Been, 2008), affordable housing is a development type that has some externalities on host communities. This externality can be positive for the residents (Baum-Snow & Marion, 2009), but sometimes it generates conflict between development proponents and host communities (Tighe, 2010) and therefore has negative externalities on them.

Research in the United States (Tighe, 2012) has shown that while a high proportion of people support the construction of affordable housing in their towns and cities, they tend to be less supportive of its construction in their own neighborhood. Such attitudes present a challenge for the delivery of affordable housing and have seen localized opposition to planned developments characterized by many observers as a self-serving “Not in my backyard” (NIMBYism) approach, despite a growing literature that takes serious issue with the NIMBY concept (see Sturzaker (2011) for a summary of the latter).

A series of studies have found that objector concerns about planned affordable housing development tend to center on three sets of issues: the potential impacts on crime and safety, property values, and other valued aspects or features of the host neighborhood; the characteristics and behaviors of prospective residents; and the physical form (bulk, style, density) of the proposed development, its ongoing maintenance, and the process of planning assessment (Hogan, 1996; Iglesias, 2002; Koebel et al., 2004; Nguyen et al., 2013; Ruming, 2014a, 2014b; Sarmiento & Sims, 2015; Scally & Tighe, 2015; Schively, 2007; Tighe, 2010).

To date, attempts to test the impacts of affordable housing development on host areas have focused mainly on property value impacts. The logic here is that property values operate as a form of proxy for the bundle of characteristics and features that influence the quality of life and amenity of a neighborhood (Galster et al., 2003; Heo & Kang, 2012; Ki & Jayantha, 2010). People are willing to pay a high price for a property in a neighborhood with low crime rates, ample parking, little traffic, and an attractive appearance. Any negative impact on these desirable characteristics, however, whether due to affordable housing development or anything else, will ultimately be reflected in property values through a reduction in the value of local properties.

A series of studies in the United States have found that the impacts of affordable housing development on property values can be positive, neutral, or negative, largely depending on the specific characteristics of the development, its residents, and the location (Ellen et al., 2007; Freeman & Botein, 2002; Galster et al., 2003). Reviewing the existing literature, Nguyen (2005) states that affordable housing development can indeed lower property values. However, she also argues that the likelihood of negative property value impacts will largely depend on project design, management, and location; negative impacts are most likely where the quality, design, and management of the development are poor, where the location is in a run-down and disadvantaged area, and where affordable housing residents are clustered.

We can divide the effects of affordable housing on hosted communities to the amenity effect and disamenity effect. In studies where a positive effect is seen, the amenity effect is dominant, and in studies where a negative effect is seen, the disamenity effect is more important. For example, the Low Income Housing Tax Credit (LIHTC) increases nearby property values by 3.8-6.5 percent in low-income neighborhoods due to housing investment and incoming middle-class households (amenity effect) (Baum-Snow & Marion, 2009; Diamond & McQuade, 2019; Ellen et al., 2007) and decreases nearby property values by 2.5 percent in high-income areas because it brings in neighbors with relatively low income (disamenity effect) (Diamond & McQuade, 2019). Studies examining these externalities date back to the 1960s, but there are three reasons to believe that there is not enough evidence to make a definitive statement about the nature of the relationship.

First,a multitude of different types of affordable housing programs exist (Ellen et al., 2007). The nature of the program and the way in which it is implemented might have implications for the price of neighboring houses. Second, most available studies focus on small geographic areas, usually a few neighborhoods, a city, or a county, and therefore, results may not be generalized to other places (Woo et al., 2016). Finally, all available studies are done in developed countries with high government effectiveness and trust (Diamond & McQuade, 2019). The externality of public housing projects might be very different in developing countries like Iran due to poor government effectiveness and a lack of trust from citizens. This study tries to fill this gap by providing estimates of the externality of a very large public housing project in Iran as a developing country.

More broadly, our paper is related to literature that examines the spillovers to neighborhoods of housing policies. Rossi-Hansberg et al. (2010) study the impact of urban revitalization programs implemented in the Richmond, Virginia area on local land prices. Campbell et al. (2011) examine the effects of housing foreclosure on housing prices nearby. Ellen et al. (2013) look at how foreclosures impact local crime rates. Finally, Autor et al. (2014) study the effect of ending rent control on nearby real estate prices and crime rates.

The lack of relevant data often prevents analysts from exploring some important issues that are directly relevant to the developing economies that are operating at a different stage of development with less mobility, urbanization, and industrialization. While there has been much documentation on the formation of residential satisfaction and the evolution of housing policy in developed nations, relatively little has been written about these topics in developing nations. The externalities of affordable housing built by governments may be more negative in developing economies compared to counterparts in the developed world, but we don’t have any research about them because of the lack of appropriate data and research in these countries. This research studies these effects in developing economies and will hopefully find parts of these externalities.

3. Conceptual framework

Building affordable housing for low- and middle-income households can affect the host neighborhood and its property values through three main mechanisms. The first mechanism can be the amenity effect. For example, in urban areas, subsidized housing often replaces abandoned, vacant lots, which are disamenities that can signal that the community is disorganized and that criminal activity will go largely unchecked. The removal of such blights can help make a neighborhood appear safer and more attractive, thereby catalyzing neighborhood revitalization.

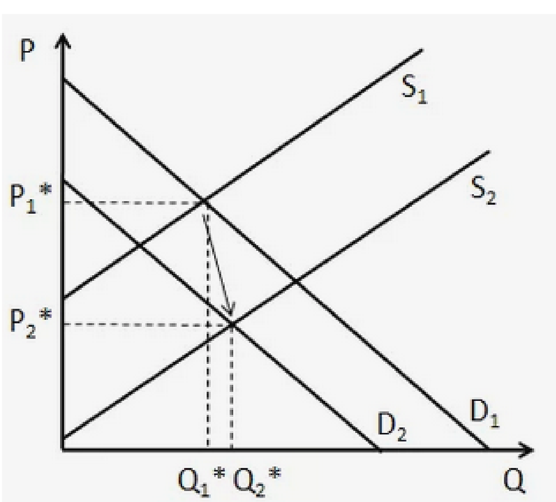
In general, we expect that investments in housing – whether the rehabilitation of old housing or the construction of new housing – would have positive spillovers on the surrounding community, especially when that housing replaces an abandoned or otherwise blighted site. There would be other amenity mechanisms too, which include bringing infrastructures like road and utilities to the neighborhood. However, those positive impacts might be tempered to some degree by poor or incongruous design, deficient management and upkeep, and/or the perception that tenants – either because of their lower relative incomes or different ethnic compositions – will make undesirable neighbors (Ellen, 2007).

A countervailing mechanism is the disamenity effect. As an example, the construction of a building or set of buildings may also have an independent effect, over and above the removal of the prior use. In particular, if a new subsidized project is viewed as unattractive or not fitting with the existing character of a community, or if a project is not cared for over time and has bad quality, it may detract from the appeal of a community (Ellen et al., 2007) and have a disamenity effect, so the property values will decline. In addition, Affordable housing developments may lead to higher congestion in a poorly equipped locality and therefore the quality of services like schools and hospitals may worsen for previous residents if new schools and public services are not constructed there. Also, the impacts of new housing may depend on who moves into it and how their incomes and cultural conditions compare to those of existing residents. Since Mehr housing units were mostly for low- and middle-income households of the city and the neighborhood became famous for this, it could have a disamenity effect on the host neighborhood (See Ellen et al. (2007) for more discussions about the mechanisms of the amenity or disamenity effect).

The third type of mechanism is the supply effect. This mechanism, as mentioned previously, can be very strong in the case of Mehr housing project and, along with the disamenity effect, can lead to a reduction in the property values of the host community.

In Figure 2, we present how these mechanisms can shift the supply and demand curve and therefore the price and value of existing residential units.

Figure 2. Housing supply and demand curve in Mehr neighborhood



Assuming that – before the construction of Mehr housing in the hosted neighborhood – S1 and D1 are the supply and demand curve of the neighborhood, then Q_1^* and P_1^* are the equilibrium quantity and price. Amenity and disamenity effects shift the demand curve. If we assume the disamenity effect is stronger in the Mehr project case, the demand curve shifts downward to D2 as a result. The supply effect shifts the supply curve downward (S2). So, the new equilibrium is Q_2^* and P_2^* where the price will certainly be lower, but the effect is an aggregation of the supply and disamenity effects.

4. Background and data

4.1. Mehr housing scheme

Housing prices in Iran increased by an average of 23 percent annually between 1990 and 2019 while GDP per capita (current USD) has only increased by an average of eight percent annually during the same period. This pattern has created serious concerns about the ability of the poor to acquire a decent home. The Iranian government started a very ambitious program in 2007 to subsidize the construction of around two million housing units in urban areas to increase the supply of affordable housing (about 18 percent of housing stock of cities at that time) to control the surging house prices and lower the burden of housing expenditures on poor households. This plan, popularized as the Mehr housing project, planned targeted apartments suitable for low-income households and facilitated the construction of mostly concentrated complexes in the suburbs of cities. The construction of Mehr units started from 2007 until 2013 and their delivery dates started from 2011 until 2020.[3]

The Mehr project provided three forms of housing subsidies. First, the government provided the project site under a long-term (99-year) rental contract at subsidized prices. Second, developers received a subsidized loan which was transferred to buyers upon the completion of the project. Third, developers received tax exemptions; eligibility for the scheme was based on not owning a property.[4] The scheme covered 1,135 cities out of approximately 1,200 cities across the country. The sheer size of the project and inadequate guarantees for the loans resulted in a massive budgetary burden which was mainly financed by money base expansion. The cumulative budgetary cost of the scheme is estimated (Rahpoo Sakht corporate, 2012) to be around IRR 1,500 thousand billion (33 percent of GDP of Iran at that time) which resulted in the doubling of the money base.

The Mehr scheme was implemented in three different types of cities. A total of 18 Mehr cities were established through this scheme; 858 small cities with a population of less than 25 thousand individuals and 259 large cities with a population of more than 25 thousand individuals received

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[3] The distribution of construction and delivery date can be seen in the appendix (Figure 7).
[4] Other eligibility criteria can be found in the appendix (8.2).

varying levels of Mehr construction projects. There were three streams of Mehr construction projects. The owner-developer stream was for individuals who had their own land and a small-scale construction plan. This stream received a government backed loan subsidy. These projects were dispersed throughout cities and there is no information of their whereabouts in our sample. The two other streams were "tripartite agreements" and "cooperative projects,"[5] which were mostly concentrated projects in selected localities of cities. These were the visible projects of the Mehr scheme, and we therefore focus on them. We collect data on the timing and location of Mehr projects in 19 large cities (provincial capitals).[6] Newly established Mehr cities are not useful for studying the local externality of public housing projects. Small cities also have very few postal regions (our unit of analysis) and therefore fail our identification strategy. The selected cities for our study are Arak, Gorgan, Hamedan, Orumia, Zahedan, KhorramAbad, Qom, Shahre-Kord, Kerman, Bojnurd, Semnan, Birjand, Ilam, Kermanshah, Zanjan, Sanandaj, Rasht, Yazd, and Bandar-Abbas.

It is worth noting that the resale of Mehr housing units was prohibited until 2013. From this date onward, the government allowed for resale of the units. However, the resale procedure differed from typical houses. Our house transaction data does not include any Mehr transactions prior to 2013 and might include transactions after the first resale of Mehr units after this date.

4.2. Data

Our first dataset is from the TMIS, which is owned by the Ministry of Industry, Mines, and Trade. This information system provides detailed public records on housing characteristics and transactions data registered by real estate agents. We use the universe of house transaction data in 19 large cities of Iran between 2010 and 2019 and merge them with information on the completion of Mehr housing projects based on time (month and year) and location (postal region).[7] Since our transactions data include postcode, we use the postal region's map of these cities to transfer postal region (the first five digits of the postcode) to geographical coordinates. With this strategy, we assume that each transaction took place in the centroid of the postal region. Our second dataset is from the Ministry of Roads and Urban Development regarding address, type, and scale of Mehr housing projects in each city. We use their address and Google Maps location to find their exact geographical coordinates. The third data that we need is the completion date of each unit. For this purpose, we use the starting date of repayment of bank installments for each unit. When a unit is completed, the bank gives the owner a booklet of bank installments and we get this data for units

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[5] We discuss these streams in the appendix in more detail.
[6] There are 31 provinces in Iran, but eight center of province cities did not have a Mehr housing scheme with Tripartite Agreement and Cooperative projects inside the city limits, so we put them aside and our data from 19 out of 23 remaining center of province cities were complete. We use these 19 cities as our selected sample, which encompass most regions of the country.
[7] The data are publicly available here.

of selected cities from the bank's data. These datasets and their sources are summarized in the appendix.

The summary statistics of the main parts of these data are described in Table 1. In the appendix, we present more details about these data. In the nine years (from May 2010 until April 2019) for which we have data, 341,106 transactions occurred in our sample (19 cities), around six percent of which were in the Mehr postal region. In all of our sample, there are transactions that occurred 63 months before the delivery of Mehr units in the city as well as transactions 102 months after the delivery of Mehr units in that city.

Table 1. Summary statistics

Variable name	Obs. (1)	Mean (2)	Std. Dev. (3)	Min (4)	Max (5)
Panel A: House transactions data					
Total house price (million tomans)	341,106	138.2	160.0	0.1	12000
Price of $1m^2$ (thousand tomans)	341,106	1387.1	1132.3	1	40000
Age	341,106	7.0	6.2	0	87
Area	341,106	95.7	48.6	20	2000
Months since March 2010	341,106	50	28	1	112
Month interval after delivery of Mehr Project	341,106	14	28	-63	102
Transactions "NEAR" Mehr postal region	341,106	0.07	0.26	0	1
Transactions in Mehr Postal region (dummy)	341,106	0.06	0.23	0	1
Transactions after Mehr delivery in Mehr region (dummy)	341,106	0.04	0.21	0	1
Distance with Mehr Projects (KM)	341,106	5.12	2.67	0	14.5
Panel B: Postal regions data					
Mehr Postal region Area (KM^2)	24	1.24	1.76	0.14	7.63
Postal region Area (KM^2)	694	0.4	1.23	0.005	21.3
Panel C: Mehr housing data					
Number of Mehr projects (not self-owning) in each city	19	194	127	14	520
Number of Mehr units (not self-owning) in each city	19	11,033	6,028	2,457	28,684
Number of schools constructed in Mehr site in each city	19	5.6	4.6	1	18
Year of starting construction of Mehr Projects	3,684	2010.2	1.2	2007	2019
Year of delivery of Mehr Units	207,868	2014.3	1.90	2010	2020
Mehr Housing Projects average area (m2)	3,684	84.2	10.8	70	110
Ratio of Mehr housing units to housing stock in each city	19	10%	7%	2%	28%
Panel D: City characteristics data					
Average area of residential units	19	109	15	85	137
Population of cities	19	452,538	237,963	153,860	1,074,036
Share of apartments in housing stock	19	34%	16%	9%	65%
Housing stocks in each city	19	129,058	67,972	41,286	301,986
Ratio of ownership in each city	19	55%	5%	43%	63%

On average, 194 projects (or 11,033 Mehr units) were planned to be constructed in these 19 cities, the starting date of which was, on average, in the first half of 2010, but their average delivery time was during the first half of 2014. It is worth noting that the average area of Mehr housing projects is about 84 square meters, but the average area of residential units in these cities was about 109 square meters, which is quite larger. Also, there is some heterogeneity between our sample cities.

For example, the ratio of Mehr housing units to housing stock in each city differs from two percent to 28 percent and the ratio of ownership in each city has values between 43 and 63 percent.

5. Empirical strategy

We rely on a DID strategy to estimate the reduced-form effect of Mehr housing units on nearby house prices. Intuitively, we compare the change in the price of housing units in the postal region of Mehr projects to the change in the price of housing units in other postal regions at the time Mehr housing units were delivered to applicants. Table 2 reports the basic DID figures. The average house price in Mehr postal regions is IRR 6,996 thousand before Mehr units are delivered (column (1) in panel A). During the same period, average house prices for other postal regions is IRR 8,840 thousand (column (2) in panel A). This suggests that Mehr postal regions include lower value properties. Panel B reports average prices after the delivery of Mehr units. Since these transactions are after those in panel A, we observe larger averages in panel B compared to panel A. However, the increase in non-Mehr postal regions is larger than that of Mehr postal regions. It seems that the delivery of Mehr units has significantly reduced average prices for nearby properties by IRR 3,715 thousand.

Table 2. Prices in Mehr and other postal regions before and after project implementation

Prices in selected cities (Thousand **r**ials per $\boldsymbol{m^2}$)	**Mehr postal regions**	**non-Mehr postal regions**	**Difference**
	(1)	(2)	(3)
Panel A: Before Mehr project delivery			
Average price	6996	8840	-1844
	(100)	(21)	(205)
Number of transactions	2931	124208	
Panel B: After Mehr project delivery			
Average price	11854	17413	-5559
	(65)	(29)	(177)
Number of transactions	15959	198008	
Panel C: B - A	4858	8573	-3715
	(205)	(39)	(224)

Notes: Panel A shows the average transaction price of houses before Mehr project delivery in Mehr postal regions (column (1)) and other postal regions (column (2)). Column (3) shows the difference between columns (1) and (2). Numbers in parenthesis are standard errors of the estimated mean. Last row of each panel reports the number of house transactions under each category. Panel B shows similar statistics for transactions occurring after the Mehr project units were completed. Panel C reports the difference of panels B and A.

We can implement the DID estimation strategy in a regression framework as follows:

$$lnp_{ipt} = \phi Mehr_{pt} + X_{ipt}\theta + \delta_t + \gamma_p + \epsilon_{ipt} \quad (1)$$

Here, lnp_{ipt} is the natural logarithm of the price for transaction i in postal region p on monthly date t. $Mehr_{pt}$ is a dummy variable that turns one when the transaction is occurring after the delivery of Mehr units in a Mehr postal region. Since Mehr units were delivered in different years across cities, we can include period (δ_t) and postal region (γ_p) fixed effects to allow for flexible global time effects and arbitrary time invariant differences in average house prices across postal regions respectively. X_{ipt} includes the natural logarithm of built area and age of the transacted unit. Standard errors are clustered at the postal region level.

In this specification, ϕ is the parameter of interest and measures the differential percent change in house prices across Mehr and non-Mehr postal regions. In order to interpret this as the causal impact of Mehr units on nearby properties, we need to assume that, in the absence of Mehr projects, the percent change in prices across Mehr and non-Mehr neighborhoods would have been the same. We have a rich variation in the timing and location of Mehr projects, which justifies our reliance on a DID estimation strategy. The exact date of completion of Mehr projects (monthly date) could be thought as quasi-random as it is a function of many factors, including the competence of the developer, weather conditions, and disbursement of loans. However, we try several additional specifications to make sure that our results are not driven by omitted factors.

First, house prices might have different trends across cities. In most of the cities, there is only one postal region that contains Mehr projects. Therefore, for most cities there is a given date after which we assume the Mehr postal region is treated. Correlations between city specific trends and the timing of Mehr project completion might cause issues for our identification. To rule out this possibility, we add city by month fixed effects to control for flexible differential time trends in house prices across cities. In this specification, we solely rely on the differential evolution of house prices within each city to identify the impact of Mehr.

Even with city by time fixed effects, we might expect a differential time trend for Mehr postal regions within a city because in the majority of cities, Mehr postal regions are located in the suburbs. For various reasons, suburbs might have different trends compared to central regions and our estimated coefficient might be capturing just this differential trend. In order to overcome this second threat, we categorize postal regions in each city into quartiles of distance from the city's center and include quartile specific time fixed effects in our regression. Effectively, this allows for a flexible divergence of house price trends for postal regions in the four quartiles of distance.

The third concern arises because Mehr sites are government-owned land. It might be that postal regions with more government owned land are of a different quality than other postal regions and therefore house prices have a different trend in such locations. We do not have information on the share of publicly-owned land across postal regions. However, we calculate average property values in postal regions in the first year of our sample (2010) and include the interaction of this average price with time fixed effects as an additional control. This specification would also control for mean reversion concerns.

Mehr projects could affect their own properties as well as neighboring postal regions. In specification (1), we only measure the impact on own postal regions. To measure the two effects separately, we add a dummy variable that turns on for postal regions neighboring (within a two-kilometer radial distance) Mehr postal regions ($Near_{pt}$) to the previous specification as follows:

$$lnp_{ipt} = \phi Mehr_{pt} + \psi Near_{pt} + X_{ipt}\theta + \delta_t + \gamma_p + \epsilon_{ipt} \quad (2)$$

ϕ and ψ capture the effect of Mehr units on house prices within the same postal region and in neighboring postal regions, respectively. It is worth noting that this specification estimated a cleaner effect of Mehr units because it allows for an impact on neighboring postal regions. In the previous specification, we assumed a zero effect on these regions.

We employ two additional specifications to look at the heterogeneity of the Mehr effect and possibly shed light on the mechanisms. Mehr housing units followed a standard affordable housing design with an average area that is smaller than the average of the existing housing stock. A total of 88 percent of Mehr units have an area between 75 and 110 square meters. Therefore, we expect the negative supply effect to be stronger for houses within the same area band of the project. To test this hypothesis, we include interactions of the built-up area dummies with the Mehr dummy. We split transactions into five area classes (less than 50, between 50 and 75, between 75 and 110, between 110 and 140 and more than 140 square meters).

$$lnp_{ipt} = \phi_0 Mehr_{pt} + \Phi_1 Mehr_{pt} \times Area_{Cat\,ipt} + X_{ipt}\theta + \delta_t + \gamma_p + \epsilon_{ipt} \quad (3)$$

Here, Φ_1 contains a set of parameters that capture the differential impact of Mehr units on different area categories.

Also, the Mehr impact might change over time due to several reasons, such as the gradual occupation of units or the development of local amenities. To allow for a time varying impact, we include variables that show the number of years passed since the delivery of Mehr units as follows:

$$lnp_{ipt} = \phi_0 Mehr_{pt} + \Phi_1 Mehr_{pt} \times YrsPassed_{ipt} + X_{ipt}\theta + \delta_t + \gamma_p + \epsilon_{ipt} \quad (4)$$

Finally, to test whether the availability of schools has a positive effect, we include the interaction of school availability with the Mehr dummy in (5). Φ_1 captures the differential impact of Mehr units in cities with a larger number of available schools.

$$lnp_{ipt} = \phi_0 Mehr_{pt} + \Phi_1 Mehr_{pt} \times School_{ipt} + X_{ipt}\theta + \delta_t + \gamma_p + \epsilon_{ipt} \quad (5)$$

6. Results

6.1. Main results

Table 3 shows estimation results for three versions of the main specifications (1) and (2). Columns (1) and (4) include only postal region and time fixed effects. House prices in Mehr postal regions see a 6.6 percent reduction. This coefficient estimate is significant at the ten percent level. Once we control for postal regions close to Mehr postal regions, we see that the magnitude of the effect becomes larger. Based on column (4), housing prices fall by 8.4 percent in Mehr postal regions. Neighboring postal regions also see a reduction of 7.3 percent. In columns (2) and (5), we add city by year fixed effects, which make the Mehr coefficient larger in magnitude and more significant. Allowing for a more flexible specification with city by time fixed effects in columns (3) and (6), we observe that house prices in Mehr postal regions fall by around 11 percent as a result of the completion of Mehr projects. This is our preferred specification because it allows city-specific flexible trends. For several reasons, cities might experience local booms and busts that might covary with Mehr completion dates. It is worth noting that in columns (3) and (6), the Mehr coefficient is similar with and without controlling for neighboring postal regions. In fact, in column (6), the near coefficient is smaller and insignificant at conventional levels. We include house characteristics available in our data in the regressions and their coefficients are as we expect.

Table 3. Main regression results

Dep.Var.: lnp_{ipt}	Mehr postal region			Mehr and neighboring postal regions		
	Baseline	City×Year F.E.	City×Time F.E.	Baseline	City×Year F.E.	City×Time F.E.
	(1)	(2)	(3)	(4)	(5)	(6)
Mehr	-0.066*	-0.089**	-0.108***	-0.084**	-0.096**	-0.110***
	(0.039)	(0.043)	(0.033)	(0.039)	(0.043)	(0.029)
Near				-0.073*	-0.064***	-0.034
				(0.040)	(0.024)	(0.031)
Age	-0.014***	-0.014***	-0.022***	-0.014***	-0.013***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ln (Area)	-0.137***	-0.138***	-0.327***	-0.137***	-0.312***	-0.138***
	(0.014)	(0.015)	(0.121)	(0.0147)	(0.030)	(0.0142)
Postal region F.E.	Y	Y	Y	Y	Y	Y
Time F.E.	Y	Y	Y	Y	Y	Y
City×Year F.E.	N	Y	N	N	Y	N
City×Time F.E.	N	N	Y	N	N	Y
Obs.	341,106	341,106	341,106	341,106	341,106	341,106
$\overline{R}^2$	0.321	0.341	0.353	0.321	0.343	0.353

Notes: Table 3 shows coefficient estimates from regressions of the natural logarithm of house prices on covariates. Covariates include age, logarithm of area, postal region, and time fixed effect in all columns. Columns (1) to (3) include Mehr which is a dummy variable that turns on for transactions in Mehr postal regions after the first Mehr unit is delivered. In addition to the Mehr dummy, columns (4) to (6) include "near," which is a dummy variable that turns on for transactions in postal regions neighboring Mehr postal regions after the first Mehr unit is delivered. Columns (2) and (5) include city by year fixed effects. Columns (3) and (6) include city by time fixed effects. Standard errors are corrected for clustering at the postal regions and reported in parentheses. *, **, *** represent significance of estimated coefficients respectively at the ten, five, and one percent levels.

6.2. Robustness regressions

Table 4 reports robustness checks that try to address two concerns. First, Mehr complexes were usually built on government-owned lands located in the suburbs of cities. For various reasons, houses in the suburbs might have a different price trajectory than the rest of the city. In columns (1) to (3), we control for distance from the city center first by interacting distance quartile dummies with time fixed effects and then by interacting the continuous distance variable with time fixed effects. All columns show a highly significant Mehr coefficient very close to our estimates in Table 3. Again, the impact on neighboring districts is not significant. In column (4), we restrict our analysis only to peripheral postal regions on the outskirts of the cities[8] to get a more comparable sample. This eliminates more than 80 percent of our observations, but coefficient estimates remain remarkably stable. Column (5) performs another control group selection by removing postal

[8] Transactions that the distance of which to Mehr postal regions were the last ten percent (last decile).

regions that are too close (less than two kilometers between the centers of the postal regions) to the Mehr postal regions. This selection is less stringent and does not change the coefficient estimate significantly.

Second, house prices might show a mean-reverting behavior. It might be that relatively low prices in Mehr postal regions were a reason for locating projects. This creates an expectation for prices to increase to their usual path after some time, which implies an upward bias for our estimates of Mehr coefficients. Another story stemming from mean reversion suggests that expecting an increase in amenities prior to the completion of Mehr projects may have increased prices, but after the fading of such expectations, prices returned to lower levels. This second story creates a downward bias in the estimation of the Mehr coefficient. The mean reversion concern is particularly important as our data does not contain the initial years of Mehr projects and hence we cannot capture anticipation effects. Also, it might be that housing prices in relatively low-price regions will increase less than more expensive regions. In columns (6) and (7), we try to address this concern. We calculate average house prices in postal regions in the first year of our sample (2010) and interact this by time fixed effects to allow for arbitrary trends for postal regions with different levels of initial prices. Consistent with the second type of mean reversion bias, we observe a 24 percent reduction in the magnitude of the Mehr coefficient. However, the coefficient is still highly significant and in the same ballpark.

Table 4. Robustness to differential trends, selection of control postal regions and mean reversion

Dep.Var.: lnp_{ipt}	Trends by distance from city center			Restrict control postal regions to:		Mean reversion: Trends by quartiles of average postal price in 2010	
	Distance quartiles	Continuous distance		Farthest postal region	Postal regions beyond 2 km		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mehr	-0.114***	-0.104***	-0.106***	-0.106***	-0.104***	-0.081***	-0.084***
	(0.030)	(0.029)	(0.029)	(0.036)	(0.0281)	(0.030)	(0.028)
Near			-0.032				-0.029
			(0.031)				(0.030)
Age	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***
	(0.004)	(0.001)	(0.001)	(0.002)	(0.001)	(0.004)	(0.001)
Ln (Area)	-0.137***	-0.137***	-0.137***	-0.277***	-0.135***	-0.135***	-0.135***
	(0.014)	(0.014)	(0.014)	(0.026)	(0.015)	(0.014)	(0.014)
Postal region F.E.	Y	Y	Y	Y	Y	Y	Y
Time F.E.	Y	Y	Y	Y	Y	Y	Y
City×Time F.E.	Y	Y	Y	Y	Y	Y	Y
Distance to Center×Time F.E.	Y	Y	Y	N	N	N	N
Average price in 2010×Time F.E.	N	N	N	N	N	Y	Y
Obs.	341,106	341,106	341,106	63,299	315,777	334,038	334,038
$\overline{R}^2$	0.357	0.354	0.354	0.388	0.343	0.354	0.354

Notes: Table 4 shows coefficient estimates from regressions of natural logarithm of house prices on covariates. Covariates include age, logarithm of area, postal region, and time fixed effects in all columns. In column (1), we divide distance between transactions and the center of each city into four categories and allow each category to have a different monthly price trend by controlling the interaction of each category by time. In columns (2) and (3), we use continuous measure of distance between transactions and the center of the city and allow different distances to have different monthly price trends by controlling the interaction of each continuous distance by month. Column (3) includes "near," which is a dummy variable that turns on for transactions in postal regions neighboring Mehr postal regions after the first Mehr unit is delivered. We define the control group of each city's Mehr housing site as the farthest postal regions of the city from the Mehr postal region and drop other transactions in column (4). In column (5), we drop transactions that are near Mehr housing site (closer than two kilometers) but are not in the same postal region and make a buffer zone for the effect. In columns (6) and (7), we divide postal regions into four categories by their average housing price in the base year (2010) and allow each category to have different monthly price trends. Some postal regions didn't have any transaction in 2010, so the number of observations in the last two columns are less than our main specification. Column (7) also includes "near." Standard errors are corrected for clustering at the postal regions and reported in parentheses. *, **, *** represent significance of estimated coefficients respectively at the ten, five, and one percent levels.

The transaction of Mehr housing units could cause an issue for our estimates. Mehr units are often of lower quality. They enjoy cheap government land as well. Therefore, they are cheaper than average residential units. Our house transaction data (TMIS) should not include Mehr housing units,[9] but we might have some of them by mistake. Nevertheless, we do two robustness checks in Table 5 to check the sensitivity of results. The transaction of Mehr units was legally allowed only after October 2013. Therefore, in our first test, we only keep transactions prior to October 2013 in columns (1) and (2). This removes 34 percent of our transactions and eliminates an interesting variation after the delivery of most Mehr units. The Mehr coefficient is reduced significantly but it is still significant at the ten percent level. In columns (3) to (6), we conduct a less stringent robustness check by removing house transactions that have a similar age to the Mehr units in that postal region. Columns (3) and (4) remove such observations only within Mehr postal regions while columns (5) and (6) remove such observations in all postal regions. Both sets of columns show a highly significant Mehr coefficient that is in the same ballpark as our preferred estimate in Table 3. It is interesting to note that we never observe a significant impact of Mehr projects on neighboring postal regions.

Table 5. Robustness to Mehr housing unit transactions

Dep.Var.: lnp_{ipt}	Keep obs. prior to October 2013		Drop houses with the same age as Mehr units			
			in Mehr postal regions		in all postal regions	
	(1)	(2)	(3)	(4)	(5)	(6)
Mehr	-0.0463*	-0.0485*	-0.100***	-0.102***	-0.079***	-0.0810***
	(0.0257)	(0.0256)	(0.027)	(0.027)	(0.025)	(0.0255)
Near		-0.031		-0.034		-0.0192
		(0.029)		(0.031)		(0.0268)
Age	-0.012***	-0.012***	-0.014***	-0.0141***	-0.011***	-0.0111***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000642)
log(Area)	-0.238***	-0.238***	-0.138***	-0.138***	-0.208***	-0.207***
	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.0137)
Postal region F.E.	Y	Y	Y	Y	Y	Y
Time F.E.	Y	Y	Y	Y	Y	Y
City×Time F.E.	Y	Y	Y	Y	Y	Y
Obs.	223,345	223,345	332,958	332,958	275,136	275,136
$\overline{R}^2$	0.293	0.293	0.353	0.353	0.317	0.317

Notes: Table 5 shows coefficient estimates from regressions of natural logarithm of house prices on covariates. Covariates include age, logarithm of area, postal region, and time fixed effect in all columns. In the first two columns, we drop transactions that occur after October 2013 when the transaction of Mehr housing units became legal. In columns (3) and (4), we drop transactions with durations lower than the difference between the date of transaction and Mehr housing construction and are also located in the Mehr postal region. In columns (5) and (6), we drop transactions with durations lower than the difference between the date of transaction and Mehr housing construction of the city in all postal regions. Columns (2), (4), and (6) include "near," which is a dummy variable that turns on for transactions in postal regions neighboring Mehr postal regions after the first Mehr unit is delivered. Standard errors are corrected

[9] Registration of housing transactions in TMIS is mandatory for ordinary residential units. However, Mehr units follow a different procedure and should not be registered in TMIS.

for clustering at the postal regions and reported in parentheses. *, **, *** represent significance of estimated coefficients respectively at the ten, five, and one percent levels.

Finally, we conduct a placebo test to check whether spurious correlation between prices in peripheral postal region and the timing of the delivery of Mehr units is responsible for the estimated impact. We assign a treatment status to the postal region at the farthest distance from the Mehr postal region. In other words, we define Mehr to be equal to one for the opposite suburb of the city but exactly at the time of the delivery of Mehr units in that city. Table 6 reports regression results of this placebo regression. We remove Mehr postal regions from these regressions. This table is formatted similarly to Table 3, which shows our main results. Mehr and near coefficient estimates are small and insignificant in all specifications. This finding is encouraging and shows that secular peripheral trends are not responsible for the estimated coefficients.

Table 6. Placebo regression results

Dep.Var.: lnp_{ipt}	Mehr postal region			Mehr and neighboring postal regions		
	Baseline	City×Year F.E.	City×Time F.E.	Baseline	City×Year F.E.	City×Time F.E.
	(1)	(2)	(3)	(4)	(5)	(6)
Mehr	0.024	0.013	0.012	0.024	0.013	0.012
	(0.034)	(0.021)	(0.020)	(0.034)	(0.021)	(0.020)
Near				0.002	-0.001	-0.004
				(0.029)	(0.025)	(0.023)
Age	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***	-0.014***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ln (Area)	-0.141***	-0.142***	-0.141***	-0.141***	-0.142***	-0.141***
	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)	(0.014)
Postal region F.E.	Y	Y	Y	Y	Y	Y
Time F.E.	Y	Y	Y	Y	Y	Y
City×Year F.E.	N	Y	N	N	Y	N
City×Time F.E.	N	N	Y	N	N	Y
Obs.	323,376	323,376	323,376	323,376	323,376	323,376
$\overline{R}^2$	0.316	0.336	0.348	0.316	0.336	0.348

Notes: This table shows the results of the same specifications as Table 3, except that we assume that the Mehr project was constructed in the farthest postal region from the real place of the city and in the same time. It shows coefficient estimates from regressions of natural logarithm of area, postal region, and time fixed effect in all columns. Columns (1) to (3) include "Mehr," which is a dummy variable that turns on for transactions in Mehr postal regions after the first Mehr unit is delivered. In addition to the Mehr dummy, columns (4) to (6) include "near," which is a dummy variable that turns on for transactions in postal regions neighboring Mehr postal regions after the first Mehr unit is delivered. Columns (2) and (5) include city by year fixed effects. Columns (3) and (6) include city by time fixed effects. Standard errors are corrected for clustering at the postal regions and reported in parentheses. *, **, *** represent significance of estimated coefficients respectively at the ten, five, and one percent levels.

6.3. Heterogeneity of Mehr effect

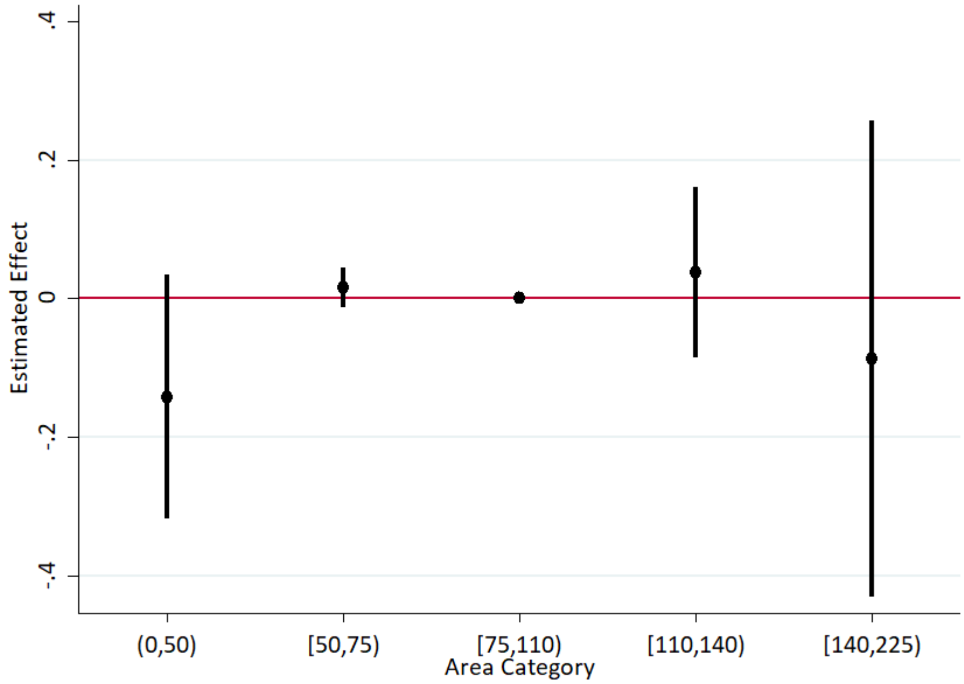
So far, we have established a robust result that after Mehr units are delivered to applicants in a postal region, we observe a fall in the price of nearby properties of around 11 percent. Two categories of mechanisms could be responsible for this negative impact: supply and disamenity. Mehr projects delivered a large number of housing units and would therefore increase housing supply, which reduces prices. Figure 9 shows Mehr units as a percentage of existing housing stock in the cities in our sample. It is clear that Mehr has shifted the housing supply quite radically in some cities. The second mechanism is the disamenity effect resulting from the overcrowding and concentration of low-income households in the Mehr postal regions, which would also reduce prices. To draw policy conclusions, we need to disentangle the two effects. Activating the supply channel was the main intention of the government to control prices while the disamenity effect is simply an undesirable and unintended channel. Disentangling the two effects is a daunting task as more Mehr units might increase the disamenity effect as well. In order to establish that at least some of the estimated negative effect is due to the disamenity channel, we look at four types of heterogeneity.

First, we note that more than 80 percent of Mehr housing units have a built area between 75 and 110 square meters (see Figure 8 in the appendix). Therefore, assuming some degree of market segmentation, we expect a stronger supply effect for houses falling in the same area category as Mehr units. We also expect a more negative impact on smaller units as a sign of upward demand shifting to cheaper but larger Mehr units. However, there is no reason to believe that the amenity effect is different across area categories. Figure 3 shows the Mehr coefficient estimates for each area category taking the Mehr category (75-110 square meters) as the reference. We see no significant difference between Mehr effects in different area categories.[10,11] This pattern is more consistent with the disamenity channel.

[10] We test the equality between the coefficient of Category 3 with the coefficient of other categories separately and in all of the tests, we cannot reject the null hypothesis that this coefficient is equal to the others at ten percent. (mehrcat2=mehrcat3: F(1,699)=0.27, Prob>F =0.6033; mehrcat4=mehrcat3: F(1,699)=0.53,Prob>F=0.4675; mehrcat5=mehrcat3: F(1,699)= 0.10,Prob>F =0.7478)

[11] We expect to see the supply effect (if existing) in the first and second category too, since Mehr households prefer larger housing units and maybe they prefer to live in Mehr housing units rather than a smaller unit that is not a Mehr unit. However, we expect that this supply effect doesn't exist for categories 4 and 5 because their areas are larger than Mehr units and mostly for richer households. So for further robustness check, we divide transactions to two categories and define just one dummy variable for transactions that have areas of more than 110 square meters, but, again, there was no significant difference between the effects in these two categories (t<1).

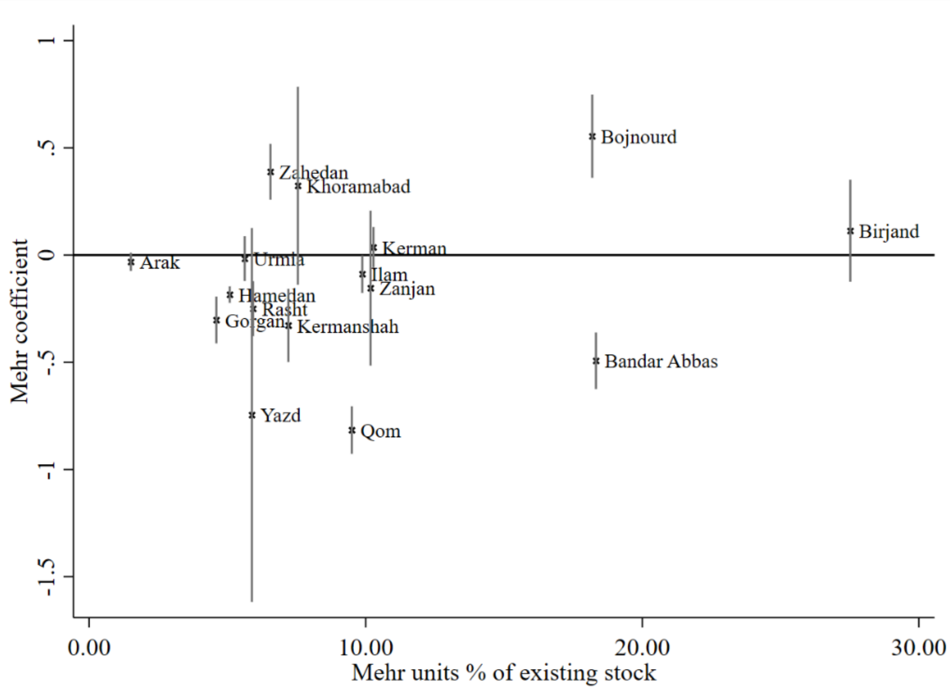
Figure 3. Heterogeneous effect in different area categories



Notes: Figure 3 shows the coefficient and standard error estimates of our intended coefficient in equation (3) of section 5 from regressions of natural logarithm of house price on covariates. Covariates include age, logarithm of area, postal region, time fixed effect, and city by time fixed effect. We drop area category of between 75 and 110 square meters (the areas of which are the same as Mehr housing units) and the results are the effect on each area category with respect to the Mehr area category.

Second, we run separate regressions for each city in our sample. Figure 4 plots coefficient estimates and 95 percent confidence intervals of Mehr effect from each regression against the scale of the Mehr project in the city. We expect the supply effect to become stronger when the scale of Mehr project is larger. However, this is not what we see in the figure. Basically, there is no clear relationship between estimated coefficients and the Mehr project scale. While this evidence does not rule out the presence of the supply effect, it is more consistent with the disamenity effect.

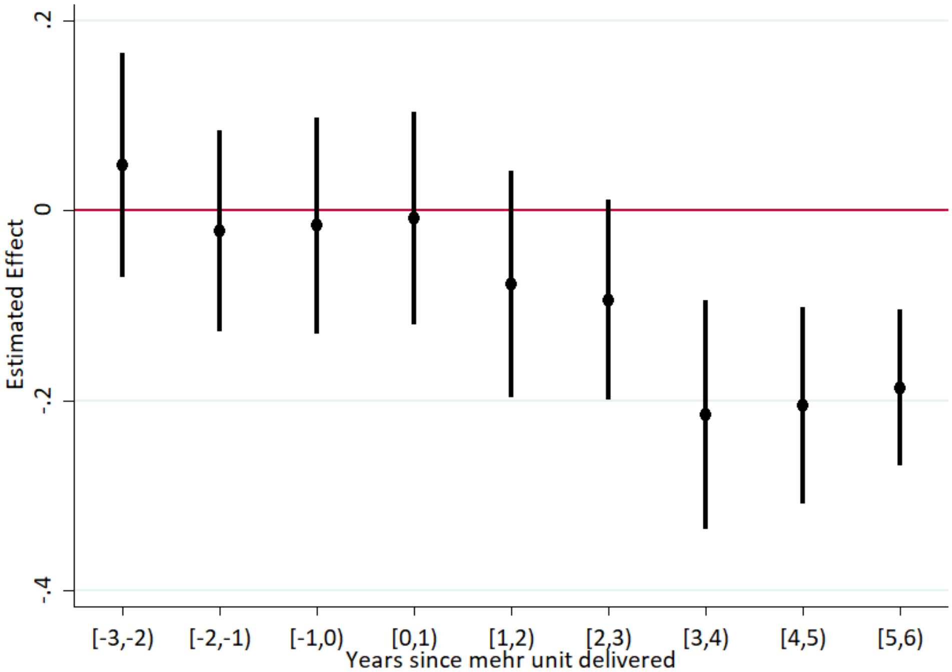
Figure 4. Relation between the Mehr effect and the size of Mehr projects in cities



Notes: Markers show coefficient estimate and grey lines show 95 percent confidence intervals for the coefficient from separate regressions of log house price on Mehr dummy, postal region, and time fixed effects in each city. The horizontal axis shows the number of Mehr units in the given city as a fraction of existing housing stock from 2011 census of population and housing.

Third, in Figure 5 we look at the time profile of the Mehr effect. As we can see from this figure, before the delivery of Mehr units, property values in Mehr postal regions and other neighborhoods are similar, which validates our identifying assumption. The negative effect starts two years after our reference point. Mehr housing units were delivered to their owners gradually and our reference point is the first unit delivery date in each Mehr project site. Once the delivery of units starts, we expect to see supply effects because households anticipate the availability of Mehr units and would withhold demand until the market supply shifts outward. However, new Mehr households would take some time to move in and hence we expect the amenity effect to start later than the supply effect. This is what we observe in Figure 5, which is more consistent with disamenity type effects.

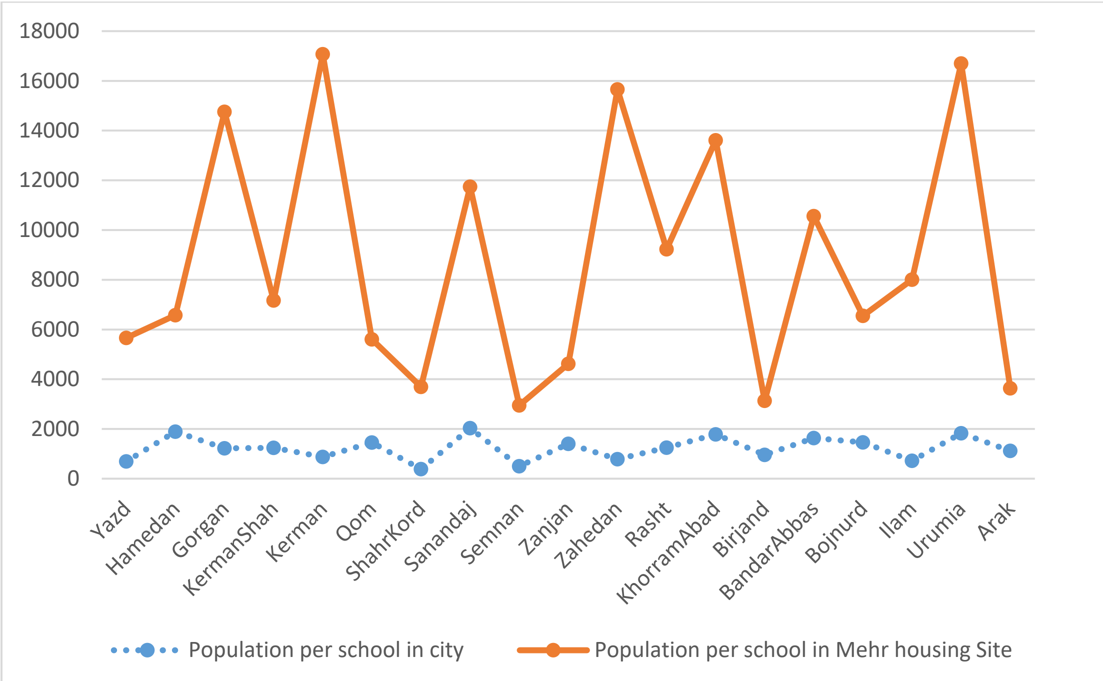
Figure 5. Effect of Mehr housing delivery in different years after and before the delivery of the first unit of the site



Notes: Figure 5 shows coefficient and standard error estimates of our intended coefficient in equation (4) of section 5 from regressions of natural logarithm of house price on covariates. Covariates include age, logarithm of area, postal region, time fixed effect, and city by time fixed effect. Our reference time is the first unit of Mehr housing delivery date in each Mehr project site and the coefficients are for the interaction of the Mehr variable and the number of years passed since the delivery of Mehr units. We have data for five years before delivery until seven years after delivery, but we show coefficients just for the three years before to six years after the delivery since the sample becomes small at the beginning and end of the range.

One of the main amenities that can impact the housing prices of each region is the number and quality of schools. We have data on the number of schools in Mehr cities and the number of schools built around the Mehr housing sites. Figure 6 reports the ratio of individuals per school in each city and for the Mehr postal region. It is evident that Mehr localities do not have as many schools as the city average for all our sample. This shortage of schools could be responsible for part of the disamenity effect.

Figure 6. Comparison between individuals per schools in Mehr postal region and for the city



Notes: Orange markers and solid lines show the number of individuals per schools in Mehr postal regions. Blue markers and dashed lines show the same ratio but for the city as a whole.

Table 7 shows the results of regressions that include school availability measures. Column (1) is reported for comparison and shows the baseline results (column (3) of Table 3). In columns (2) to (5), we include the interactions of the Mehr dummy with various school availability measures. To construct school availability measures, we first take the number of schools constructed at the time of house transaction and divide it by the planned number of schools in that region. This percentage is then divided by the percentage of Mehr units delivered at that date. The "school to units ratio" shows whether school construction progressed at the same pace at the delivery of Mehr units. In column (2), we construct a school dummy that is "one" for Mehr posral regions if more than 25 percent of schools were constructed when 50 percent of the units were delivered. In column (3), the school dummy is switched on when the "school to units ratio" is greater than one in each year in each city. In column (4), we average the school availability measure in column (3) for the whole period. In column (5), we use the exact date of transaction instead of the yearly matching. All these columns show a positive coefficient for the interaction term, which reflects the positive amenity effect of schools. Interestingly, the Mehr effect is now stronger than the baseline result, which confirms that the unavailability of schools results in a stronger negative externality.

Table 7. Impact of school availability on nearby property values

Dep.Var.: lnp_{ipt}	Baseline Result	School = 1 if school to units ratio ≥ 0.5	School = 1 if school to units ratio ≥ 1	Average of school measure in col. (3) over sample period	School = 1 if school to units ratio ≥ 1 at exact transaction date
	(1)	(2)	(3)	(4)	(5)
Mehr	-0.108***	-0.135***	-0.119***	-0.136***	-0.120***
	(0.033)	(0.0306)	(0.0307)	(0.0307)	(0.0307)
Mehr*School		0.210**	0.0762*	0.171**	0.0899**
		(0.0950)	(0.0395)	(0.0759)	(0.0402)
Postal Region Fixed Effect	Y	Y	Y	Y	Y
Time Fixed Effect(month)	Y	Y	Y	Y	Y
City*Month Fixed Effect	Y	Y	Y	Y	Y
Observations	341,106	341,106	341,106	341,106	341,106
Adjusted R-squared	0.353	0.352	0.352	0.352	0.352

Notes: Table shows coefficient estimates from regressions of natural logarithm of house price on covariates and a variable that indicates the status of the school as an amenity in the Mehr neighborhood. Covariates include age, logarithm of area, postal region, time fixed effect, and city by time fixed effects in all columns. Column (1) is repetition of our main result (column (3) of Table 3). In column (2), "school" is a dummy variable which is one if more than 25 percent of schools were constructed when 50 percent of units were delivered in each city. In column (3), this variable is one for each year in each city if the percent of schools constructed was more than the percent of housing units that were built till then in each year. This variable is average of "school" variable in column (3) in the whole period in column (4); and in column (5), it is one for each transaction if at the time of the transaction, percent of schools constructed were more than percent of housing units that were delivered. Standard errors are corrected for clustering at the postal regions and reported in parentheses. *, **, *** represent significance of estimated coefficients respectively at the ten, five, and one percent levels.

Unfortunately, we do not have more detailed postal region level data on other amenities like per capita police staff, clinics, and other variables to test the reduction in such amenities more directly. However, the above results show that school congestion as a disamenity effect is important in the context of Mehr public housing and it would be better if amenities (especially schools) were built in accordance with residential housing units or these housing units were built in scattered areas of the city.

7. Conclusion

The impact of affordable housing projects on existing properties within a neighborhood has received a lot of attention in developed countries. However, the externality of public housing projects might be very different in developing countries due to poor government effectiveness and a lack of trust from citizens. This study tries to fill this gap by providing estimates of the externality of a very large public housing project in a developing country. Our results show large significant negative effects. House prices fall by around 11 percent after the delivery of Mehr housing units.

This result is incredibly robust to a large number of specification tests. However, the effect is concentrated in the postal region of the project and neighboring postal regions do not receive a significant impact.

Two main mechanisms could explain our results: supply and disamenity effects. While Mehr housing projects are very large, four pieces of evidence suggest that the disamenity effect is present in our case. First, we show that units with a built area similar to Mehr units receive a similar impact compared to other units. Second, we observe that the scale of Mehr projects is not correlated with Mehr impact across cities. Third, we notice that the Mehr impact kicks in two years after the delivery of the first unit. This suggests that gradual occupation of units is causing the decline in the value of nearby properties, which is more consistent with the disamenity effect. Finally, we show that the negative Mehr effect is attenuated in cities that received a larger number of schools. This shows that the increased availability of schools could offset some of the negative externalities and that the negative amenity effect matters for our context.

Several potential disamenity effects might exist. The general view about Mehr units was that they are of lower quality. The concentration of low-income households and higher congestion in an already low amenity neighborhood are other potential disamenity mechanisms. The caveat in our study is that we could not provide direct evidence on these amenities because we do not have access to data at the postal region level other than the number of schools in the Mehr housing site. Anecdotal evidence and news pieces support the disamenity effect. Most Mehr residents were not satisfied with their neighborhood due to a lack of infrastructure like schools, clinics, and police stations, which leads to congestion in existing facilities.

The magnitude of our estimated effect is larger than previous studies in developed countries. For example, Diamond & McQuade (2019) show that affordable housing decreases nearby property values by 2.5 percent in high-income areas in the United States because it brings in neighbors with relatively-low incomes. The higher magnitude of our results might be due to weaker government performance and a lower trust by citizens in Iran, which is a fixture of developing country governments.

Our results pour cold water on the idea that the rapid construction of concentrated affordable housing is a good solution to rising house prices, precisely because it is very hard to supply the infrastructure required for keeping the amenities at pre-existing levels. An alternative idea is to gradually expand the stock of affordable houses in order to allow the neighborhood infrastructure to adjust. Also, the concentration of affordable housing units in a given area might be detrimental to the welfare of existing and new residents in the neighborhood.

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Appendix: Further data description

1.1 Types of Mehr projects

The Mehr project scheme can be divided into two dimensions: type of projects and type of cities. There were three types of cities that Mehr projects were built on and the authority for each type and procedure were different from the others. There were also three streams of Mehr construction projects. The owner-developer stream consists of about 45 percent of Mehr housing units (about 910 thousand units) and is for individuals who had their own land and had a small-scale construction plan (on average three units in each project). This stream received a government-backed loan subsidy. These projects were dispersed throughout cities and there is no information of their whereabouts in our sample. The two other streams were “tripartite agreements” and “cooperative projects,” which were concentrated projects in selected localities of cities. These were the visible projects of the Mehr scheme, and we therefore focus on them. In cooperative projects, members of a cooperation in each city register for getting land and loan from the government and manage the project. In tripartite agreements, there were three sides in the contract: government, bank, and developer. The government selects a developer and gives them free land to be constructed, which are mainly large-scale projects. Next, the developer receives a loan from the bank, which will be transferred to Mehr applicants by the subsidy of the government. Table 8 presents a detailed number of planned units in each city and project type.

Table 8. Number of Mehr units by city type and project type

City type	Owner-developer units		Tripartite Agreement units		Cooperative units		Total
	Share(percent)	Units	Share(percent)	Units	Share(percent)	units	
More than 25k	67	608875	44	239798	65	390199	**1238872**
Less than 25k	29	267941	0	20	23	134732	**402693**
New cities	4	33797	56	305189	12	74297	**413283**
Total	100	910613	100	545007	100	599228	**2054848**

Note: This figure shows division of Mehr housing units by their type of project and type of cities. There exists three types of cities: cities with a population of more than 25 thousand and managed by the Ministry of Housing, cities with a population of less than 25 thousand managed by the National Land and Housing Organization, and new cities which were under control of New Towns development CO. Three streams of Mehr construction projects were in practice. The owner-developer stream was for individuals who had their own land and had a small-scale construction. The two other streams were “tripartite agreements” and “cooperative projects,” which were concentrated projects in selected localities of cities.

1.2 The target population of the Mehr project

The targeted population were low-income households who were almost from the four bottom deciles. Since the buyer should bring some cash at the beginning of the plan and be able to easily pay the installments after getting the home, very poor households can’t afford to register in this plan. However, middle- and high-income households also cannot register in this plan because of the registration conditions. Registration conditions for this plan were: 1) they should be married and head of household; 2) none of their family members should have ownership of land or a housing unit since 2005; 3) they should not have used government facilities or land since the revolution (1979); and 4) they should have lived in the registered city since at least five years before registration. Furthermore, around four percent of houses were given to very poor households that were covered by supportive institutions like the State Welfare Organization of Iran. This means that most of the target population were low- and middle-income households of that city which didn't have homeownership although they were not necessarily very poor people.

1.3 Data sources

We get our data from five different sources, the details of which can be found in Table 9.

Table 9. Data details and sources

Data title	Source	Description
Housing Transactions in cities	Tenement Management Information System (Ministry of Industry, Mine, and Trade)	From 2010 to 2018 Including postal code, age, area, transaction date and price
Mehr housing projects properties	Ministry of Roads and Urban Development	Including address, number of units, construction date
Delivery date of Mehr units	Maskan (Housing) Bank installment data	Starting date of repayment of bank installment
Location of Transactions and Mehr projects	Post Company and Google Map	Postal map of each city with its postal region's exact location
Selected cities housing stock information	Population and housing census (Statistical Center of I.R. Iran)	Census of 2011 including ownership rates, number of housing stocks, share of apartment units, average area of houses…etc. of each city

1.4 Other details about Mehr housing

As mentioned previously, we have selected 19 cities from the largest cities that Mehr units were built in. All of these 19 cities are the center and the most important city of the province. As can be seen in Table 10, from the 629,997 Mehr units that were built in cities with a population of more than 25 thousand (except self-owned that are scattered in the city), 209,602 units were built in the 19 cities mentioned previously (about 33 percent of total). It can be seen in the following table that the starting date of construction of these projects were mostly before 2010. Unfortunately, our transaction data starts after that time. However, the first delivery date of all the cities is after 2011, and therefore we can compare the data we have before and after the delivery date. We got the address and number of units of Mehr projects in these cities from the Ministry of Roads and Urban Development. In this dataset, the starting date of each project of each city is specified, but for the delivery date of each unit, we use the starting date of repayment of bank installments from Maskan (Housing) Bank. When a unit's construction is finished, the loan for that unit is transferred to the owner and the bank gives the installment booklet and the key to the residential unit to the owner simultaneously. Hence, we get this date for each unit and use the date of the first unit that was delivered as date of delivery to owners in the following table.

Table 10. Details of Mehr housing in selected cities

City	Number of Mehr Projects	Number of Mehr Units	Number of concentrated Projects (not self-owned)	Number of concentrated Units	Year of Starting Construction	Year and month of delivery to owners (first unit)
Bandar Abbas	470	30,496	169	20,568	2008	Jan-13
Ilam	570	7,006	56	4,078	2008	Apr-12
Yazd	645	11,996	131	9,276	2009	Apr-12
Kermanshah	3,421	32,384	48	16,396	2010	Sep-12
Rasht	980	21,226	205	12,852	2009	Sep-13
Zanjan	3,334	22,021	520	10,637	2008	Nov-11
Sanandaj	1,198	16,919	190	10,079	2009	Nov-12
Qom	1,726	37,342	234	28,684	2009	Apr-12
Orumia	1,630	14,835	431	10,060	2010	Sep-12
Zahedan	916	9,672	271	7,640	2008	May-11
Kerman	1,153	32,384	138	16,396	2008	Oct-11
Hamedan	730	11,585	136	8,135	2009	Jan-12
Arak	1,059	8,450	14	2,457	2010	Oct-12
KhorramAbad	3,760	15,268	100	6,822	2011	Oct-13
Gorgan	1,416	14,774	28	4,566	2010	Mar-13
Bojnurd	2,291	16,771	190	9,600	2009	Apr-13
Birjand	1,053	17,101	217	13,020	2009	Mar-12
ShahrKord	741	9,009	267	7,247	2010	Nov-12
Semnan	372	11,798	310	11,089	2008	Mar-12
All 19 cities	27,465	341,037	3,655	209,602	-	-
All “>25k population” cities	188,323	1,238,872	10,651	629,997	-	-
Share of selected cities	15%	28%	34%	33%	-	-

Figure 7. Number of Mehr units started and delivered in each year

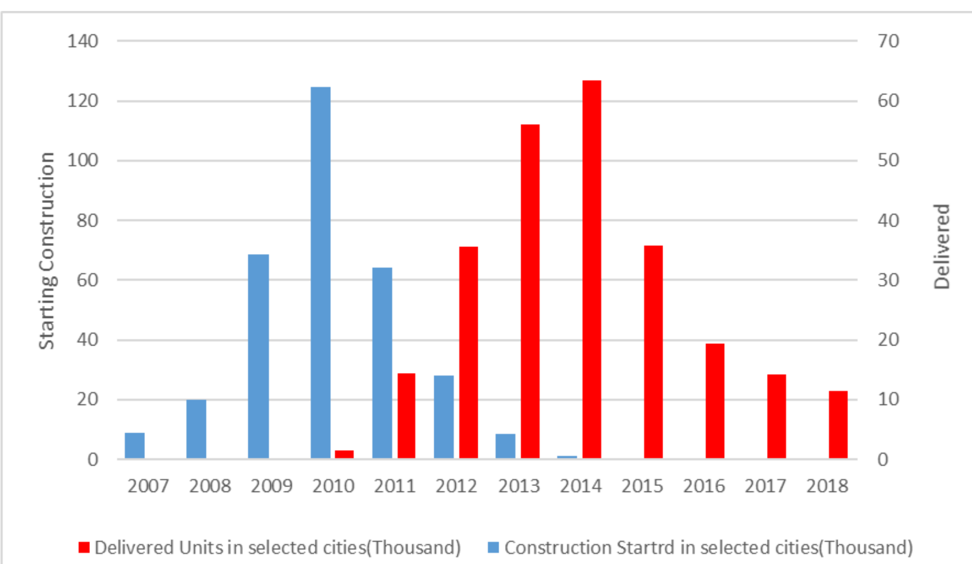


Figure 8. Distribution of area of Mehr housing units in sample cities

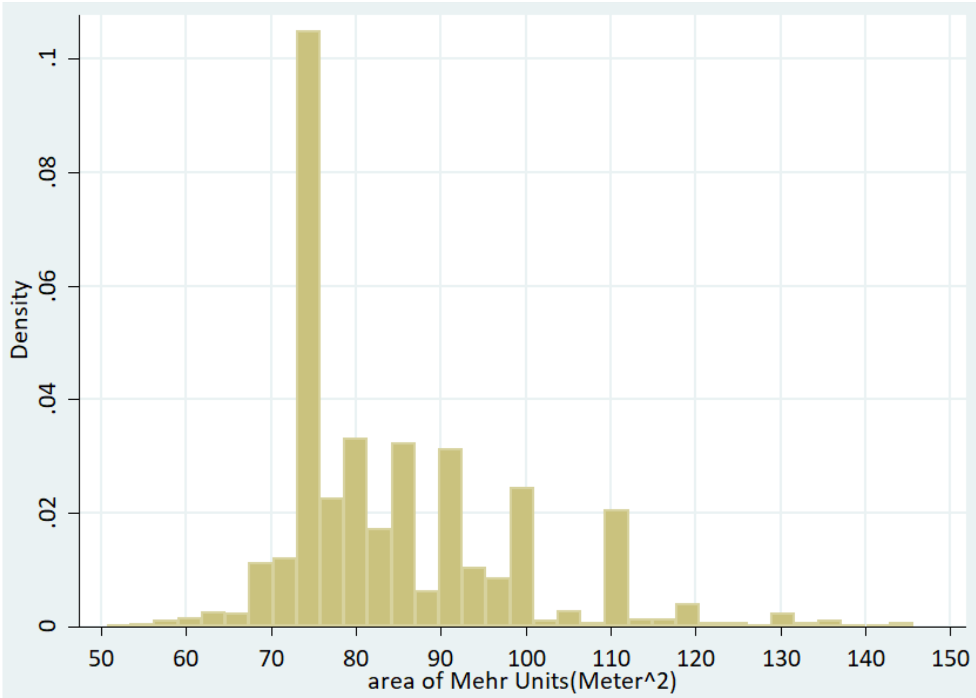
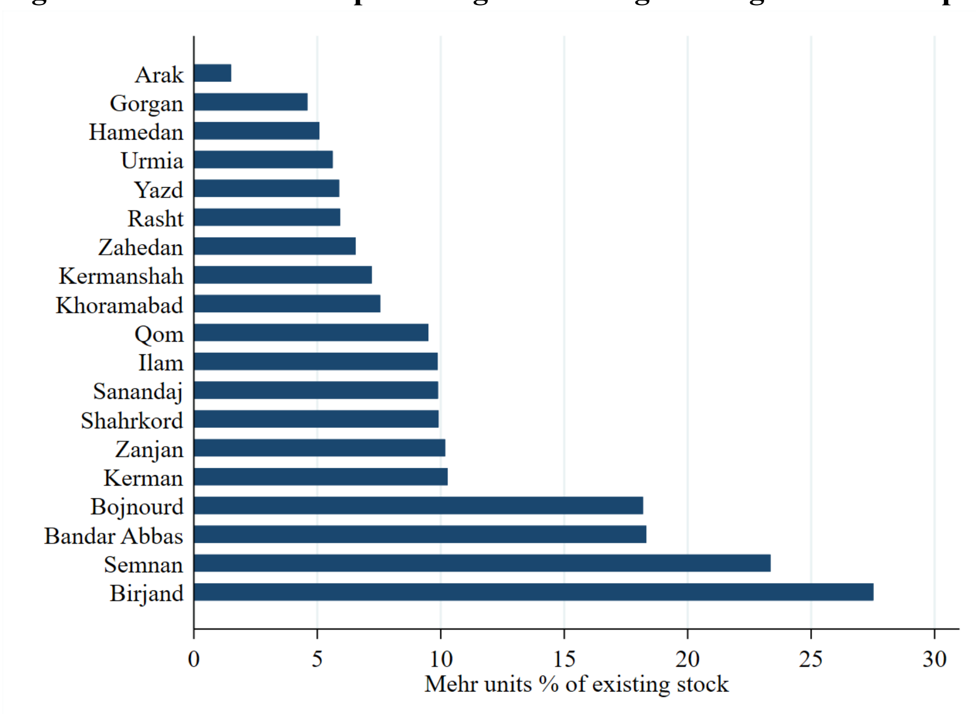


Figure 9. Mehr units as a percentage of existing housing stock in sample cities



1.5 Transactions

Official transactions of residential units occur in real estate consultant firms and after that are registered in the TMIS. These firms record a residential unit's information, including postal code, age, area, transaction date, and price. This process is mandatory for residential unit transactions for finalizing the transfer. However, this is different for Mehr Housing units. First of all, until the end of 2013, transferring Mehr units was illegal, and the owner could not sell the unit. After 2013, however, the buyer and seller should go to the Department of Roads and Urban Development of the city to transfer the unit and register it there. They should also transfer the loan and rent contract with the government. For this reason, registering in the TMIS was not mandatory for Mehr units, therefore the data we have contain ones other than Mehr units. This deduction is even more legible for transactions before 2013 since no units could be sold before that time.

In the following table, we present the summary statistics of transactions in the selected cities for the years 2010 until 2019. A total of 142,309 transactions are registered in these cities in this interval, which is about five percent of all transactions registered in the country.

Table 11. Summary statistics of transactions in the selected cities

Year	Transactions	Average Price (million rials)	Average area	Average age
2010	31,381	655	91	9
2011	41,364	703	91	8
2012	58,744	909	92	8
2013	41,821	1,190	92	7
2014	50,035	1,444	93	6
2015	47,526	1,374	94	6
2016	22,428	1,760	98	5
2017	20,591	1,971	102	6
2018	22,288	2,416	100	6
2019 (until half)	4,928	3,606	99	7
Total interval (selected cities)	341,106	1,332	94	7
Total interval (country)	3,434,854	2,398	91	7.5

From these 341,106 transactions, only 20,976 of them belonged to Mehr housing postal regions. The table below shows the distribution of these transactions in the selected cities.

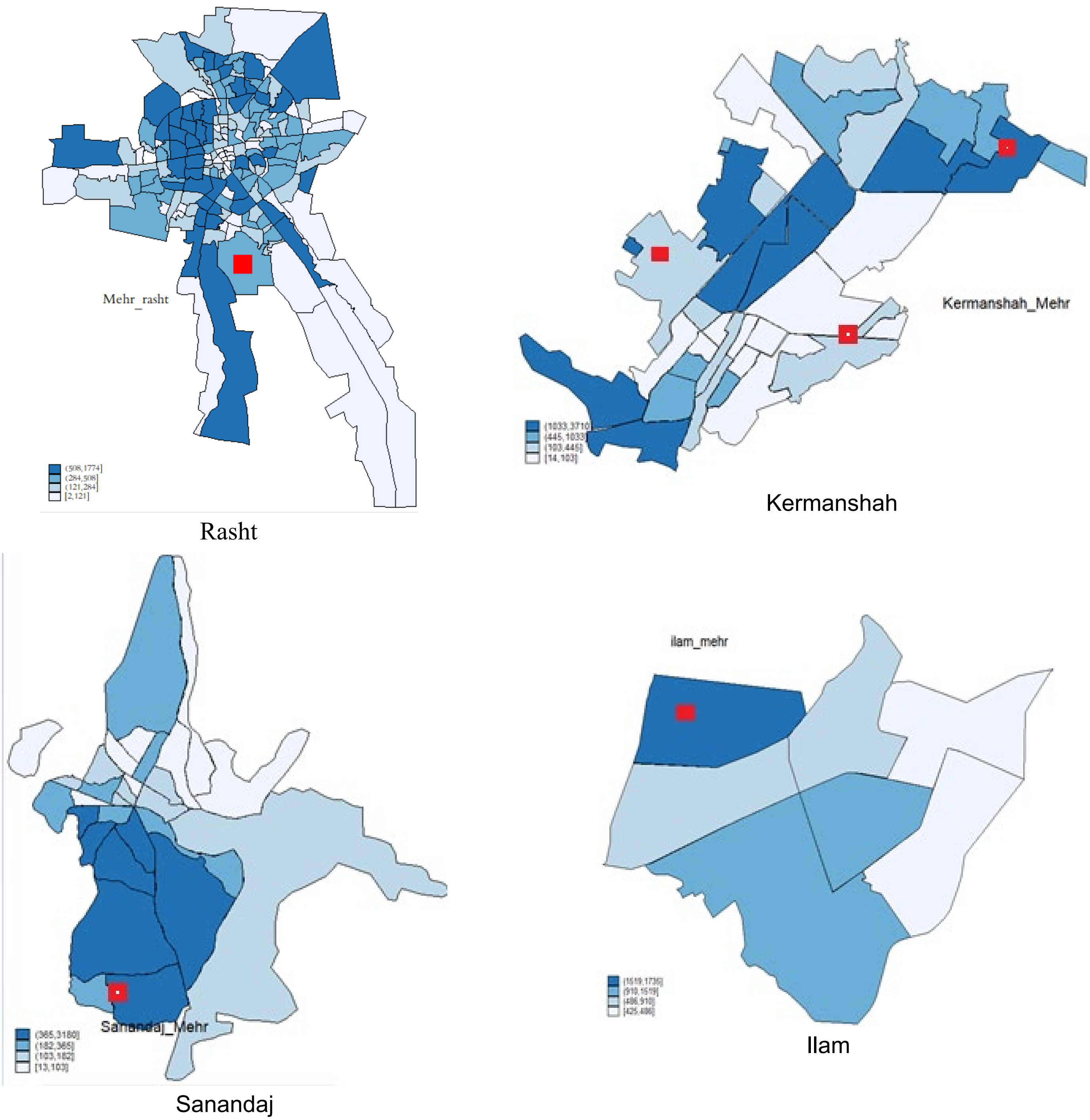
Table 12. Transactions in Mehr postal regions and other regions of each city

City	Total Transactions	Transactions in Mehr postal regions
Arak	28,332	1,366
Urumia	17,613	773
Ilam	6,871	1,735
Bojnurd	7,318	303
BandarAbbas	11,361	1,581
Birjand	3,901	247
KhorramAbad	3,066	457
Rasht	67,598	1,063
Zahedan	4,636	1,011
Zanjan	12,623	396
Semnan	15,945	551
Sanandaj	13,543	219
SharKord	5,671	113
Qom	26,176	3,473
Jerman	10,255	782
Hamedan	44,375	5,252
Yazd	3,400	55
Kermanshah	26,355	1,025
Gorgan	33,058	574
Total	342,097	20,976

1.6 Postal regions location

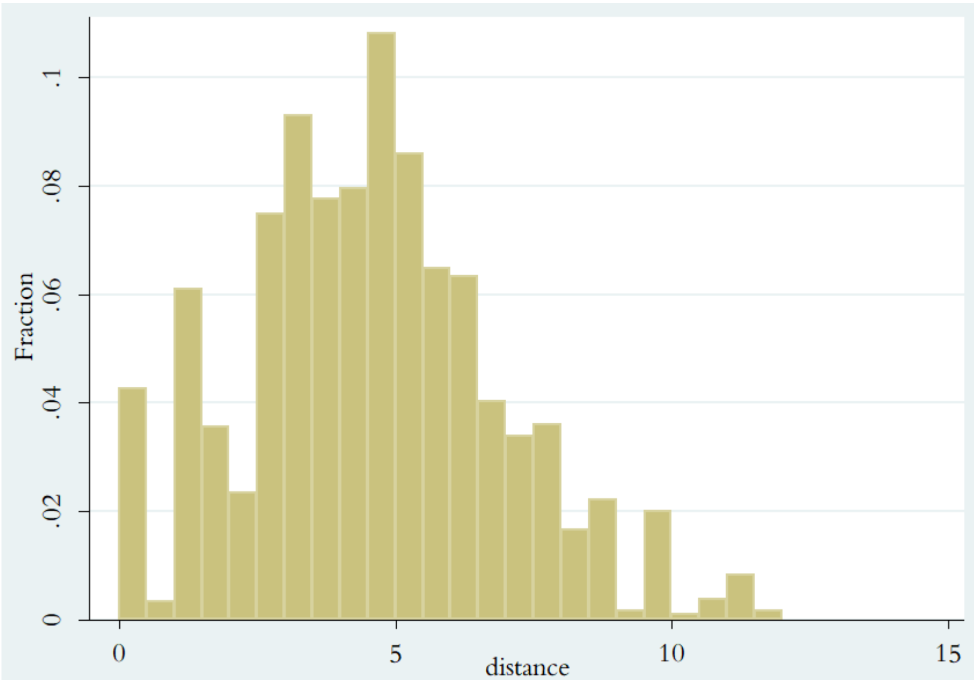
The postal regions of Rasht and their number of transactions can be seen in the figure below. Mehr projects have one main site in each city where most of the projects (except self-owned) were built. We specify the location of this site in the figure with a red square.

Figure 10. Map of postal region in Rasht, Kermanshah, Sanandaj, and Ilam (four of the selected cities) and the Mehr location (red square)



After specifying the location of the Mehr housing main site and each city's transactions, we calculate the distance between each transaction's postal region and the Mehr postal region. The following figure shows the distribution of the distance.

Figure 11. Distribution of transacted units from the Mehr site location in each city



1.7 Housing stock information of selected cities

To show the heterogeneity of the selected cities, we use population and housing census data done in 2011, including ownership rates, number of housing stocks, share of apartment units, average area of houses, and population of each city. The summary of the information about the selected cities can be seen in the following table. As can be seen, these cities are different from each other in various aspects. For example, just nine percent of units in Urumia are apartments but this share is about 65 percent in Arak. Also, the average area of units is 85 square meters in Rasht, while it is 137 square meters in ShahrKord.

Table 9. Housing stock information of selected cities

City	Population	Housing stock	Share of owners	Share of Mehr units (except self-owned) to housing stock	Share of apartment units in the housing stock	Average area of residential units
Arak	484,212	162,802	56%	2%	65%	96
Urumia	667,499	178,850	63%	6%	9%	135
Ilam	172,213	41,286	60%	10%	17%	112
Bojnurd	199,791	52,776	51%	18%	35%	101
BandarAbbas	435,751	112,333	43%	18%	44%	93
Birjand	178,020	47,308	50%	28%	37%	112
KhorramAbad	384,216	90,380	52%	8%	11%	113
Rasht	639,951	216,821	60%	6%	43%	85
Zahedan	560,725	116,534	44%	7%	25%	119
Zanjan	386,851	104,515	57%	10%	30%	104
Semnan	153,860	47,479	59%	23%	54%	111
Sanandaj	373,987	101,924	53%	10%	32%	90
SharKord	159,775	73,122	60%	10%	23%	137
Qom	1,074,036	301,986	51%	9%	54%	96
Kerman	534,441	159,513	54%	10%	25%	122
Kermanshah	851,405	227,596	50%	7%	27%	101
Gorgan	329,536	99,266	56%	5%	49%	100
Hamedan	525,794	159,966	59%	5%	56%	99
Yazd	486,152	157,653	61%	6%	16%	135